

**Terrestrial Vegetation and Habitat Diversity Module
for the
Timberland Planning Component**

**California Department of Fish and Game
Northern California - North Coast Region
Interior Timberland Planning Team**

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Resource Issue

To reach economic goals, industrial timberland owners often seek to develop highly managed forests - timberland that is well-stocked with healthy, vigorously growing conifers which can be efficiently cultivated and harvested. Certain forest components can hinder these goals by competing directly with desirable conifers, taking up growing space that faster-growing conifers could occupy, or complicating the work environment for forestry staff and equipment. These components can include:

- Grasses, shrubs, and hardwoods that compete with conifers (in stands dominated by conifers or in areas judged to be capable of supporting conifer-dominated stands)
- Openings or gaps in forested habitats
- Slow-growing or defective conifers (due to age, competition with neighboring trees, injury or disease, etc.)
- Conifer species which are judged to be more susceptible to disease, insect attack, fire, or drought than other desirable species
- Woody debris that hinders efficient replanting efforts and vegetation maintenance, contributes to an increased risk of fire danger, or that may be economically utilized

In areas that are intensively managed for timber production, these components are often selected against during timber operations or are indirectly affected by competition and shading from the selected crop trees (particularly in plantations, where trees are initially densely planted and thereafter generally well tended). A potential result of these practices is the simplification (structurally and compositionally) of plant community structure on lands managed for the production of commercial forests. Unevenaged forests may be simplified as they are replaced by plantations, shrub- and hardwood-dominated areas may be "rehabilitated" into plantations, hardwood trees in mixed hardwood/conifer stands may be killed by herbicide injection, large/decadent/diseased/non-commercial trees in unevenaged stands may be prioritized for harvest to provide space for rapidly growing, trees, etc.

Landscape studies, fire-ecology studies, and historic datasets indicate that, prior to landscape modification resulting from settlement by European-Americans (primarily grazing, intensive timber harvest, and fire suppression), montane areas in California and the Pacific Northwest generally consisted of a patchy mosaic of different habitat and stand types driven primarily by the interaction of localized biotic conditions, ecological conditions (regional climatic conditions, temperature gradients, soil moisture gradients, etc.), and disturbance events such as fire, pest and disease outbreaks, windthrow, etc. (Agee 1998, Taylor and Skinner 1998, Chang 1996). Patches resulting from these interactions and fine-scale gap dynamics varied in size, structure, and composition (Spies and Franklin 1989). In contrast, the size, structure, and composition of industrially-managed forest stands are planned to facilitate management and economic returns, and are generally controlled through various harvest entries and maintenance operations throughout the growth cycle. These procedures, coupled with active fire suppression, are likely to limit the effects of natural disturbances upon those stands. Regardless of these intentions, however, the combined effects of existing environmental gradients, natural disturbances, diverse ownership patterns, and unplanned management inefficiencies may produce considerable variation within and among many stands in heavily managed landscapes (Hansen et al. 1991).

A growing body of literature indicates that structurally and compositionally complex forests play an important role in maintaining biodiversity and ecological function in forested landscapes (summarized in Franklin et al. 1997 and Hansen et al. 1991; also Halpern and Spies 1995, Neitlich and McCune 1997, Rambo and Muir 1998; Amaranthus et al. 1994, North et al. 1997). According to the Department of Fish and Game's (DFG) California Wildlife Habitat Relationships program many habitat elements that may potentially be adversely impacted by intensive management are of importance to numerous wildlife species, (examples are included in Table 1) (California Department of Fish and Game 1999).

Thus, it is important to discern whether the effects of industrial forestry upon plant community structure, vegetation diversity, and habitat elements are sufficient to cause substantial negative changes to biodiversity and ecosystem function within site-specific areas (e.g., planning watersheds, timber company management tracts, etc.). Potential negative impacts on plant community structure and diversity are most likely in those areas where industrial ownership is concentrated and where physiographic and vegetation diversity (existing vegetation and/or potential natural vegetation) is limited. Proactive planning at the landscape level, based on analysis of existing ecological conditions, may help ensure that future industrial forest management does not cause long-term adverse changes to biological diversity.

Table 1: Wildlife species associated with selected California Wildlife Habitat Relationships elements

WHR element	Definition	# of species associated with element		
		<u>Essential</u>	<u>Secondarily Essential</u>	<u>Preferred</u>
Layer, herbaceous	Sub-canopy herbaceous vegetation, >10% cover	61	115	206
Layer, shrub	Subcanopy shrubs, >10% cover	35	152	233
Layer, tree	Subcanopy trees >10% cover	20	132	147
Tree/shrub	Transition between any stand of trees, size class 3, 4, 5 or 6, and tree size classes 2, or shrub classes 2, 3 or 4	1	57	158
Trees, hardwood	Hardwood trees w/ dbh > 11 in.	3	58	127
Tree, with cavities	Trees possessing one or more cavities	18	47	74
Snag, large, rotten	DBH > 30 in.	0	39	104

Essential elements must be present within the home range of a species for the species to be present.

Secondarily essential elements must be present within the home range of a species for the species to be present unless compensated by the presence of other secondarily essential elements that serve the same function to the species.

Preferred elements are used by the species to a greater degree than what would be expected from abundance; these elements enhance the value of the habitat, but are not essential for species presence.

Goal

- Ensure that vegetation types and habitat elements are maintained in sufficient quantity and quality within each planning watershed to provide functional habitat (as defined for wildlife in Title 14 California Code of Regulations Section 895.1) for all species native to those watersheds

Objectives

- Collaborate with timber companies to develop a better understanding of the potential effects of intensive forest practices on vegetation structure and composition, in both the short and long-term
- Promote industry planning for adequate wildlife needs at various landscape scales (planning watersheds, tracts, ownerships, etc.)
- Develop an assessment methodology that permits identification and analysis of terrestrial resource conditions (e.g., early seral vegetation, forest understory diversity, hardwoods, mature and/or decadent trees, snags, etc.) at various scales and that can be used to help guide the implementation of the Interior Timberland Planning Team's (Team) resource-specific terrestrial ecology modules (hardwoods, snags, early seral vegetation).

Strategic Plan

Initial implementation efforts should be focused on 1) working with industrial companies to understand whether current and planned management is likely to

contribute to cumulative adverse impacts to wildlife at the landscape level, 2) encouraging company plans and policies that will minimize any identified potential impacts, and 3) developing an assessment methodology that will identify and/or guide the long-term monitoring of terrestrial wildlife resources at various scales.

Collaborative analysis and planning

Because the effects of long-term industrial management at the landscape level in California remain uncertain, the Interior Timberland Planning Team (Team) should work with the timber companies to develop wildlife and habitat management plans whenever feasible, or review and evaluate their internally developed plans. Each company has produced a general planning document(s) (Option A plans, Sustained Yield Plans, etc.) which indicate company management plans and strategies for multiple decades and explain (in varying degrees of detail) the constraints to be imposed upon wood production by the maintenance of adequate wildlife habitat and biological diversity within planning watersheds. Some companies are developing specific management plans aimed at either general wildlife management or management of specific wildlife habitat elements. Evaluation of these management plans and strategies should focus on 1) existing vegetation types and habitat conditions within the area affected by an industrial landowner, 2) the spatial configuration of the ownership and its relation to other major land owners/managers, and 3) long-term company silvicultural planning and goals. Companies may maintain vegetation and habitat diversity through various means, such as diverse silvicultural treatments within planning watersheds, habitat retention areas or other applications of "variable retention" silviculture, snag and hardwood planning and management goals, etc. Each company will likely address this issue in a different way, depending on its specific management goals and philosophy.

Where opportunities arise, the Team should work with willing companies to explore the research, data, and assumptions behind these plans. Priority should be given to companies that are currently developing landscape-level habitat or habitat element management plans. Several companies are currently developing a general management plan for wildlife habitats across their ownerships. Because of these planning efforts, excellent opportunities exist for collaborative analysis and the Team input into future management direction. Opportunities to review and comment on company policies related to vegetation and habitat diversity have also arisen with companies as they begin internal development of management plans for specific wildlife habitat elements. The Team should pursue similar opportunities with other companies. Potential incentives which may encourage timber companies to collaborate with the Team in these efforts include 1) programmatic review opportunities for certain issues in Timber Harvesting Plan (THP) review, which will likely lead to a streamlined review process, and 2) enhanced public credibility resulting from the Team support for company management plans and practices.

Some company inventory data (vegetation structure and composition, density of important habitat elements, etc.) may serve as an excellent resource for evaluating habitat composition, structure and function within watersheds. The availability of such data may permit comparisons of the structure and composition between a variety of managed stand types (plantation, non-plantation evenaged, unevenaged, unmanaged areas) and also large areas (e.g., sub-watersheds) that differ primarily in the degree of intensive forest management. Encouraging companies to analyze such data (or collaborating with them on joint analysis) could provide a much better understanding of actual habitat conditions on privately-managed timberlands, which would help companies and the Team to formulate effective landscape-scale management strategies.

This general approach of collaborating with timber companies to develop a more keen understanding of the effects of management on habitats and to achieve enhanced resource protection is also employed in the Team's related Early Seral, Snag, and Hardwood planning modules. As such, review and analysis of company plans as outlined in this module should generally be guided by the specific objectives and strategies outlined in those modules. Additionally, different companies will likely develop very different management plans and strategies over time. Some may develop general plans that aim to manage all habitats and elements, while others may develop specific management strategies for particular resources. These plans and management strategies will ultimately determine how the Team should best work with each company, and whether it is most appropriate to implement the strategies of a particular module or various modules.

Resource assessment methodology

To aid the Team in its analysis of management plans and policies, its formulation of management recommendations for certain landscape areas, and its ability to monitor resource conditions over time, the Team should develop a methodology to enable assessment of terrestrial vegetation/habitat conditions and diversity at various. The assessment of a particular area should consider all habitat types and (to the extent feasible) correlated habitat elements. The assessment tool will be useful in evaluating and monitoring the assumptions and implementation of company management plans, as well as for prioritizing areas for the application of other specific terrestrial resource planning and review modules. The development of a primary assessment tool will also minimize potential redundancies associated with assessing conditions several times for a particular area during the application of other habitat-element based Team modules. Thus, the results of the assessments may also serve to aid in the site- and landowner-specific implementation of other terrestrial planning modules (i.e., early seral, hardwood, and snag). The assessment methodology should be based on the best vegetation and habitat data available.

Development of the assessment methodology will involve region-wide initial analyses and more detailed analyses of specific areas. Although the procedure

is in the early stages of development, it will likely involve concepts similar to those outlined in the following paragraphs.

Initial analyses of vegetation/habitat types should be conducted at bioregional (following USDA 1997 or a similar mapping effort) and/or planning watershed levels to determine “baseline” conditions (as of 1994) throughout areas of concentrated timberland within the NC-NCR. Planning watersheds would be stratified by bioregion (and perhaps by elevation or other physical features, if appropriate) in order to facilitate understanding of current variability within relatively similar environmental conditions. Analysis would involve tabulating the presence and amount of the various WHR types within each assessment unit. WHR types could be combined into other habitat categories as warranted (e.g., Sierra mixed conifer types 5S and 5P could be combined into a category such as “large tree, open forest”). Relevant metrics calculated for each assessment area might include the amounts of:

- forest habitat by type (Sierran mixed conifer, white fir, red fir, ponderosa pine, conifer-hardwood, etc.)
- hardwood-dominated habitat
- young/sapling-pole forest
- mature/large tree forest
- shrub-dominated habitat
- grass and herb-dominated habitat
- riparian and aquatic habitat

The Team is currently working with other Department functions in an effort to utilize the WHR habitat suitability model to predict vegetation and habitat conditions that will provide optimal and/or functional wildlife habitat within a given bioregion or planning watershed. Based on WHR habitat types present in each assessment area, the WHR model may be utilized to predict habitat suitability for various wildlife species within the area. These analyses would potentially indicate which combinations of habitat within a given bioregion lead to greatest wildlife diversity, as other values such as greatest diversity of wildlife guilds, or particular groups which may be of interest (e.g., raptors, carnivores, small mammals, amphibians, etc.). If this modeling effort is successful, it will permit the baseline conditions to be compared to the optimal and/or functional conditions for a given area. The definition of functional and/or optimal conditions for a given landscape area will also likely be guided by general literature about California vegetation and wildlife ecology (especially with regard to response to forest management and other disturbances). Using WHR as currently available, these analyses will not be able to utilize the spatial distribution of habitat types present in the assessment areas or the habitat elements likely present in each habitat type. However, Team staff are currently planning to address these issues through the development of substantial additional modeling tools.

The results of these initial analyses and comparisons could be used to prioritize regions/watersheds for further analysis and planning. Areas within particular bioregions for which the baseline and “predicted functional” or “optimal” conditions are most different should generally be given the highest priority. Other

important factors that should be considered in prioritizing areas for further analysis include:

- amount of area zoned Timber Production Zone
- land ownership patterns
- concentration/intensity of area under recent/current/planned THPs

Analysis for these high-priority areas should include accuracy of the WHR types assigned to the area in question, a detailed review of past THPs and other major land use activities/disturbance events in the area (particularly since 1994), spatial distribution and relationship of WHR types, current constraints on harvest posed by listed or sensitive species (e.g., northern spotted owl, goshawk, etc.), known occurrences of unique or rare natural communities, and identification of medium- to long-term company plans for the area (i.e., percentage and type of even-aged management, percentage and type of uneven-aged management, rotation ages, Watercourse and Lake Protection Zone management, intensity of sanitation-salvage via exemptions, etc.). Geographic Information System (GIS) coverages that would aid this analysis, but are not currently available, include low-level aerial photography, ownership by major landowner, and THP maps.

Assessment of conditions in these areas would provide information that would allow the Team to work cooperatively with private timber companies to refine existing general management plans and/or develop area-specific conservation measures. Additionally, this information could be used to identify areas in which the Team can work with the owners to develop long-term management plans that meet both the company goals and create adequate vegetation and habitat conditions.

When companies have not created habitat or habitat-element management plans, Team staff should focus on encouraging adequate management at the planning watershed or tract level. In these cases the site-specific area assessments will provide The Team with substantial information on which to base its recommendations (information regarding the use of site-specific assessments and development of specific recommendations is detailed in the Terrestrial Habitat Review Module)

Monitoring

Because appropriate scientific information is limited, the Team will not initially seek to develop its own minimum standards or thresholds for vegetation/habitat diversity at particular landscape scales. However, based on the results of its efforts to model for optimized habitat conditions in certain areas, analysis of natural variation in habitat conditions, and analysis of natural disturbance regimes, the Team will seek to encourage and contribute to company-specific industry management plans that include habitat standards and thresholds. Where appropriate, the Team should encourage timber companies to provide additional habitat diversity and habitat elements on their lands (likely via recommendations that companies modify their internal habitat goals and thresholds, or encourage practices which will hasten those goals being met).

The Team should then monitor plan implementation and effectiveness to determine whether management plan assumptions are reasonable and whether company thresholds provide adequate habitat conditions.

Several types of monitoring might be utilized:

- Periodic landscape-level reassessments of high-priority areas to detect changes in vegetation/habitat conditions and to determine the contribution of timber operations to those changes (via updated GIS-based habitat coverages)
- Implementation monitoring to determine whether company-specific thresholds or goals are being met on company lands (e.g., distribution of various habitat forms and/or elements)
- Site-specific monitoring and/or experimentation to address continuing questions about the effects of intensive management on vegetation/habitat diversity and/or directly upon wildlife

Adaptive Management

Adaptive management will be essential and should be driven by monitoring results and new research. Little is known about the minimum habitat needs of many wildlife species. Vegetation is dynamic; vegetation patterns (both structure and composition) in California have been changing for thousands of years as plants respond to environmental changes apparently caused by climatic variation (Anderson 1990, Woolfenden 1996, Stine 1994). Extensive clearcutting- and plantation-based forest management is a relatively new phenomenon in interior northern California, and most existing plantations are young (30-40 years or less). As new research and insight about these resources and practices becomes available, new perspectives regarding conditions that will sustain both commercial productivity and biological diversity in forested landscapes will likely emerge.

The Team should encourage company planning documents to be “living documents” that will be regularly reviewed and updated, and the Team should strive to provide relevant information to the companies which will help guide habitat management. Review and update timelines will likely vary by document, but intervals should not be greater than five years. Likewise, the Team should continue to refine its landscape assessment techniques. Improved datasets should be sought after and acquired when available. The Team should work closely with other DFG functions to take advantage of existing analysis methods and tools, and to develop new ones as technology advances.

The Team should seek to encourage and participate in cooperative research on the landscape-level effects of intensive forest management in California. Cooperation between various landowners, universities, and agencies may permit extensive research projects. One potential product of cooperative research is a landscape habitat model that would predict the effects of various timber management scenarios on vegetation diversity and habitat conditions within interior northern California. The Sierra Cascade Intensive Forest Management

Research Cooperative, while focused primarily on reforestation research, provides an example of and potential model for public-private cooperation in conducting research on management issues related to industrial forestry in interior northern California.

Measures of Success

Success will be measured by the extent to which the following are met:

- Development of an assessment methodology that permits identification and analysis of terrestrial resource at various scales
- Use of the assessment methodology to help guide the implementation of the Team's resource-specific terrestrial ecology modules and goals
- Effective collaboration with timber companies to develop additional knowledge regarding the potential short- and long-term effects of intensive forest management on vegetation structure and composition
- Timber companies develop effective plans for providing functional wildlife habitat at various landscape scales

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